IDAHO

FISH & GAME DEPARTMENT

Joseph C. Greenley, Director

SALMON AND STEELHEAD INVESTIGATIONS

Job Performance Report Project F-49-R-12

Job No. IV-a. Parr-Smolt Transformation in Summer-Run Steel-head Trout and Chinook Salmon

Period Covered: September 1, 1972 to February 28, 1974 by

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May, 1974

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JOB PERFORMANCE REPORT

State of Idaho

Name: SALMON AND STEELHEAD INVESTIGATIONS

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ABSTRACT:

During 1973, we examined the appearance, a parameter of physiological activity, salt water tolerance, and migration behavior of selected groups of wild and hatchery steelhead trout to determine which fish and/or rearing procedure might produce the best smolts.

During the months of April, May, and June of 1973, we tagged and released in Big Springs Creek 2,741 Niagara Springs Age I steelhead and 2,961 Hayden Creek Age II steelhead. Of the fish released, 460 Niagara Springs steelhead (16.8%) and 285 Hayden Creek steelhead (9.6%.) emigrated past the Big Springs Creek weir. Niagara Springs fish released in May accounted for 46.8% of those emigrants and Hayden Creek fish released in April accounted for 50.9% of those emigrants. The peak period of emigration for Niagara Springs steelhead was May 27-June 2. April 29-May 5 was the peak period of emigration for Hayden Creek steelhead.

Hayden Creek steelhead larger than 200 mm and wild steelhead from Big Springs Creek had Na+, K+ - stimulated ATPase activity twofold higher than the activity found in Niagara Springs steelhead and smaller Hayden Creek steelhead.

Few fish from both hatcheries survived in the salt water tests. Fish tested in March, at onset of migration, had the highest survival rate.

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RECOMMENDATIONS:

The studies of steelhead trout should be continued through the 1974 migration season to assess the importance of size, time of release and cold water acclimation on the parr-smolt transformation and migration.

OBJECTIVES:

Assess the changes in appearance, coefficient of condition, NaK-ATPase activity, and salt water survival during parr-smolt transformation of steel-head.

To correlate the extent of parr-smolt transformation in steelhead with seaward migration.

To correlate age, length, and time of release of juvenile steelhead with seaward migration.

TECHNIQUES USED:

We used Age I steelhead trout from Niagara Springs Hatchery (Snake River-Pahsimeroi River stock) and Age II fish from Hayden Creek Hatchery (Clearwater River stock) as experimental animals. In late March, juvenile steelhead reared at Niagara Springs Hatchery were hauled to Hayden Creek Hatchery and maintained in a channel (140 ft. long, 4 ft. wide and 18 in. deep) until release in Big Springs Creek or testing at the University. Steelhead reared at Hayden Creek were held in a rearing pond until April, and then moved to a channel until release or testing.

At the beginning of April, May, and June of 1973, we tagged and released juvenile steelhead of the two groups into Big Springs Creek about 5 miles up-stream from a fish weir. We recorded the tag number, length and date of emigration for each fish that we captured in the downstream trap of the Big Springs weir. In July, we estimated the number of tagged steelhead still present in Big Springs Creek with electrofishing gear.

We monitored morphological and biochemical changes in hatchery steelhead while at the hatcheries and when they migrated and also in the wild steelhead from Big Springs Creek. Changes in appearance, coefficient of condition, and NaK-ATPase were determined. We assessed salt water tolerance of steelhead by transferring the fish from fresh water to sea water of 30% salinity without
acclimation.

FINDINGS:

<u>Niagara Springs Age I</u>

We tagged and released 2,741 Niagara Springs juvenile steelhead (150 mm) total length into Big Sprins Creek (a tributary of the Lemhi River) during the months of April, May, and June 1973 (Table 1). We classified 60.3% of the fish as potential emigrants based on appearance at time of release. However, appearance may not be a good criterion for recognition of smolts from Niagara Springs because they did not completely lose the dark parr marks prior to release.

During the spring of 1973, 460 of the Niagara Springs steelhead (16.8% of the total release or 27.8% of the potential emigrants) emigrated past. the Big Springs weir site. Fish released in May accounted for 46.7% of the emigrants and had the highest migration rate (21. 5%) of all groups released (Table 1).

In July we sampled the fish population in Big Springs Creek with electrofishing gear to estimate the number of tagged Niagara Springs steelhead still remaining in the stream. We estimated 756 + or - 692 Niagara Springs steelhead in the stream in July. Thus, we could not account for 1525 ± 692 (56.5% t 25.2%) of the fish released by July (2741 fish released-460 emigrants-756 in stream in July = 1525 uncounted). These uncounted fish may have lost their tag, died from tagging and handling mortality or natural mortality, or were caught by anglers.

The peak period of emigration by Niagara Springs steelhead occurred during May27-June 2. The peak period of emigration for the April and May release occurred May 27-June 2 and for the June release June 3-9 or after release (Figure 1). Niagara Springs steelhead which migrated increased in length approximately 10 mm between time of release and time of emigration (Figure 2).

We found that the largest percentage of Niagara Springs steelhead survived transfer to salt water in March at the onset of the migratory period. During the latter stages of the migration period (May and June) few Niagara Springs steelhead survived transfer to salt water. By the end of the migration period (July) the fish were stenohaline. Conte and Wagner (1965) found similar, but more pronounced, salt water tolerance using winter steelhead trout from Alsea River.

We did not find an elevation in NaK-ATPase activity of gill microsomes in Niagara Springs steelhead which accompanies the transformation from parr to smolt (Figure 3).

Hayden Creek Age II

We tagged and released 2961 Hayden Creek Age II steelhead (> or = 150 mm) in Big Springs Creek during the months of April, May, and June, 1973. We classified 56.4% of the fish released as potential emigrants, 10.2% as parr, and 33.3% as mature males. In the spring of 1973, 285 (9.6% of total release or 17.1% of potential emigrants) Hayden Creek steelhead emigrated from Big Springs Creek (Table 2). Fish released in April accounted for 50.9% of the emigrants from Hayden Creek and the largest migration rate of all fish released (14.2%) and of potential emigrants (30.1%).

In July we estimated 470 ± 101 Hayden Creek steelhead remained in Big Springs Creek. Therefore, 2206 ± 101 or 74.5% ± 3.4% of the steelhead from Hayden Creek were uncounted for in July.

Table 1. The number of Age I steelhead from Niagara Springs Hatchery that were tagged and released into Big Springs Creek, the number classified as potential smolts on the basis of appearance, the number and percentage which migrated from the stream, 1973.

Date of release	Fish released		Potential smolts		Number and percentage of migrants			
	Number	Percentage of total	Number	Percentage	Number	Percentage of total	Percentage of release	Percentage of potential smolts
April 1	1,041	38.0	99	9.5	138	30.0	13.3	139.4
April 29	1,000	36.5	900	90.0	215	46.7	21.5	23.9
June 3	700	25.5	655	93.7	107	23.3	15.3	16.3
Totals	2,741		1,654		406		16.8	27.8

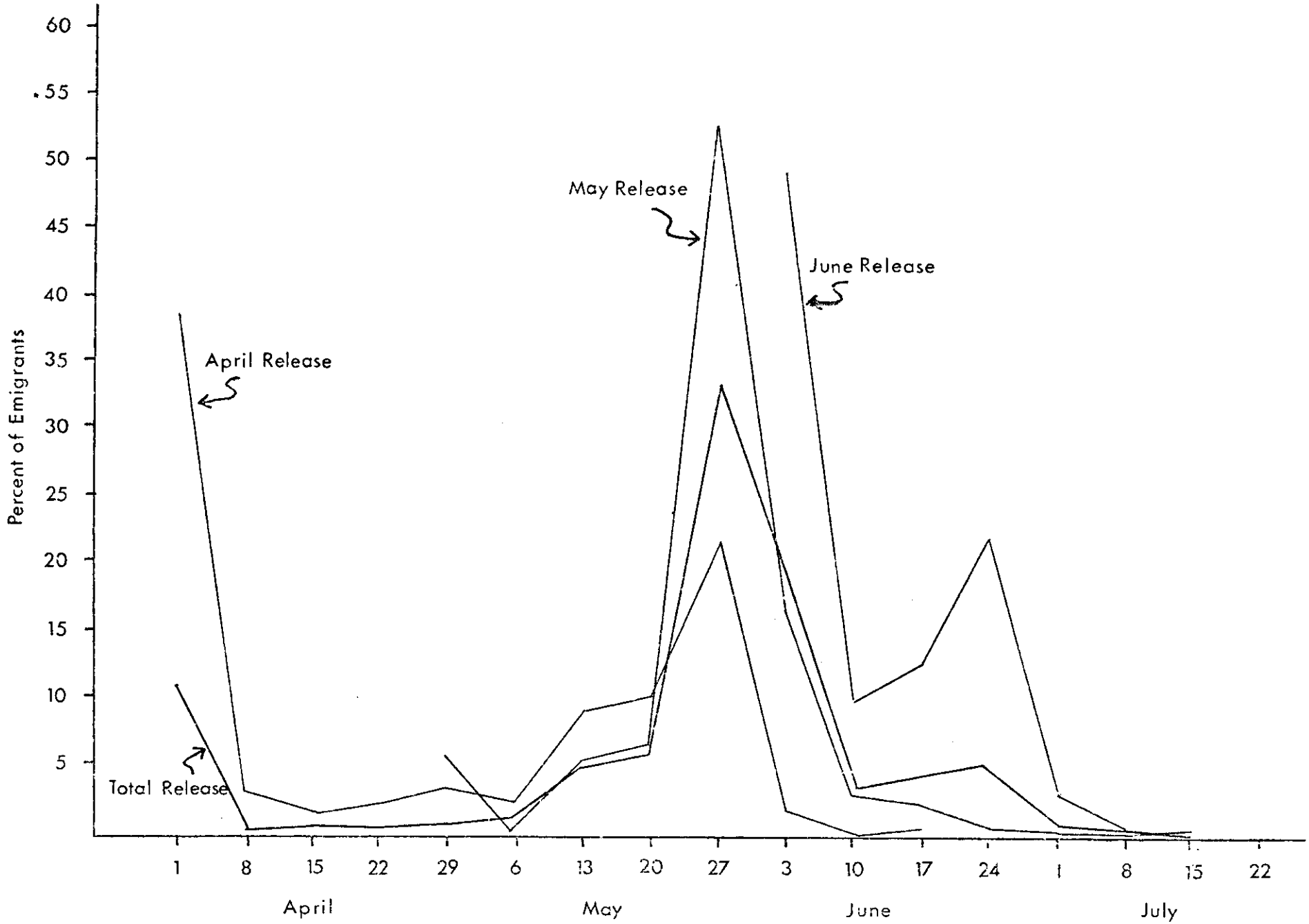

Figure 1. Time of emigration past Big Springs Creek Weir of juvenile steelhead reared at Niagara Springs Hatcher and released into the creek in April, May and June, 1973.

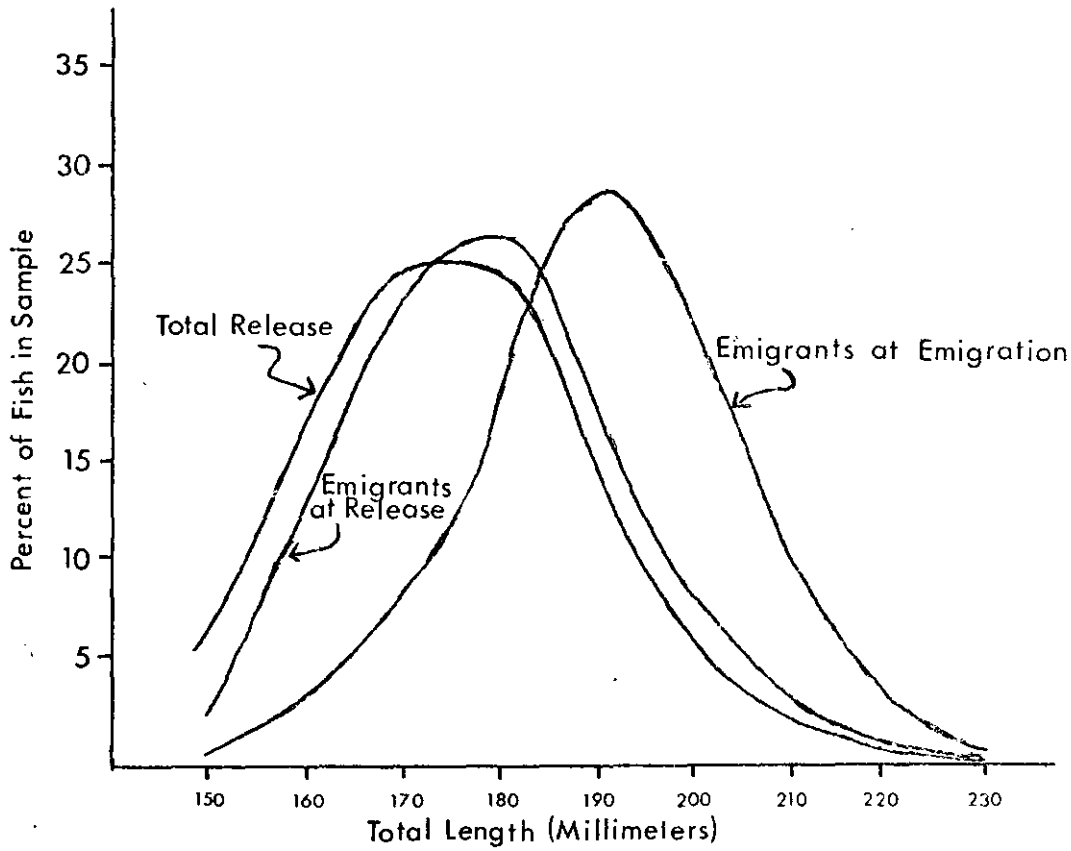

Figure 2. Length-frequency: (1) of all juvenile steelhead reared at Niagara Springs Hatchery at time they were released into Big Springs Creek, (2) at time of release of fish of the released group which subsequently emigrated from the creek, and (3) of the emigrants of the released group at the time of emigration.

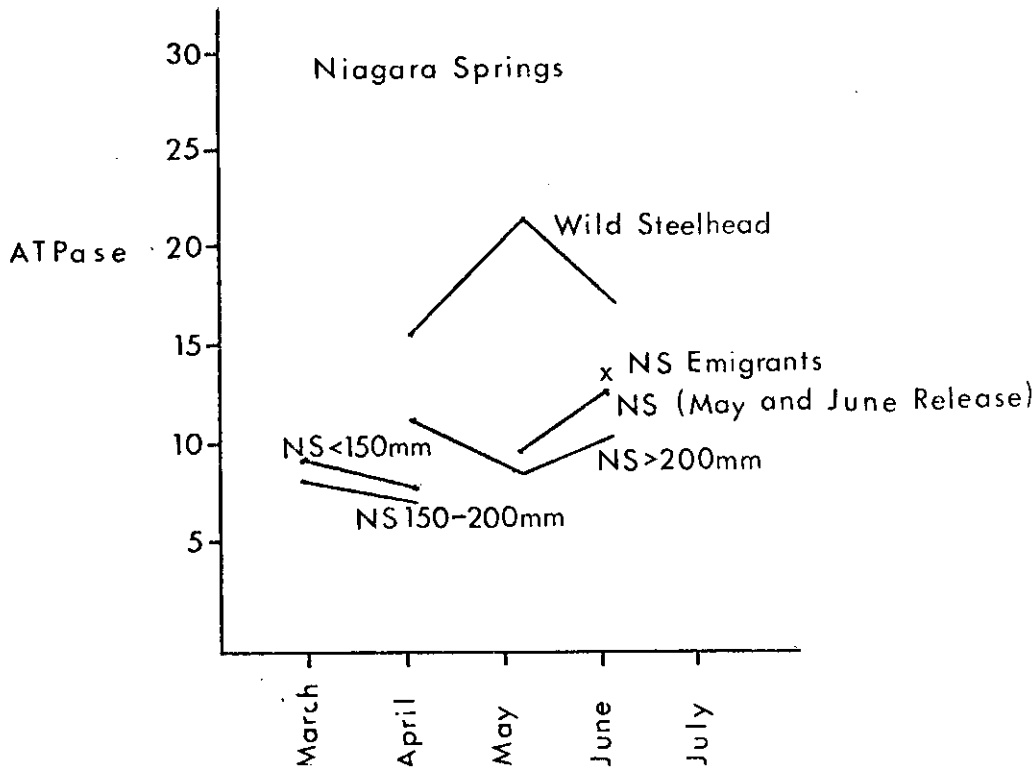

Figure 3. The concentration of sodium-potassium activated ATPase in gill tissue of juvenile steelhead reared at Niagara Springs Hatchery, of various size groups and time of spring, and wild steelhead captured at the Lemhi River Weirs.

Table 2. The number of Age II steelhead from Hayden Creek that were tagged and released into Big Springs Creek, the number classified as potential smolts on the basis of appearance, the number and percentage which migrated from the stream, 1973.

	Fish released		Potential smolts		Number and percentage of migrants			
release	Number	Percentage of total	Number	Percentage	Number	Percentage of total	Percentage of release	Percentage of potential smolts
April	1,022	34.5	482	47.2	147	50.9	14.2	30.1
May	1,045	35.3	643	61.5	94	33.0	9.0	14.6
June	894	30.2	546	61.1	46	16.1	5.1	8.4
Totals	2,961		1,671		285		9.6	17.1

Hayden Creek steelhead emigrated from Big Springs Creek at different times dependent on when they were released. Peak period of emigration for fish released the first of April occurred the week of April 22-29, fish released the first of May, May 13-19, and fish released the first of June, June 3-9 or immediately after release (Figure 4).

Hayden Creek steelhead which emigrated from Big Springs Creek were a little larger at time of migration than when they were released (Figure 5).

Hayden Creek steelhead survived transfer to sea water similar to Niagara Springs steelhead with survival highest in March, at the onset of the migration period, and lower during May and June, the latter stages of the migration period.

The Na+, K+ -stimulated ATPase activity in Hayden Creek steelhead longer than 200 mm and wild steelhead from Big Springs Creek was double
that found in mature males and smaller steelhead from Hayden Creek (Figure 6).

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Conte, F. P. and H. H. Wagner. 1965. Development of osmotic and ionic regulation in juvenile steelhead trout Salmo gairdneri. Comp. Biochem. Physiol. 14: 603-620.

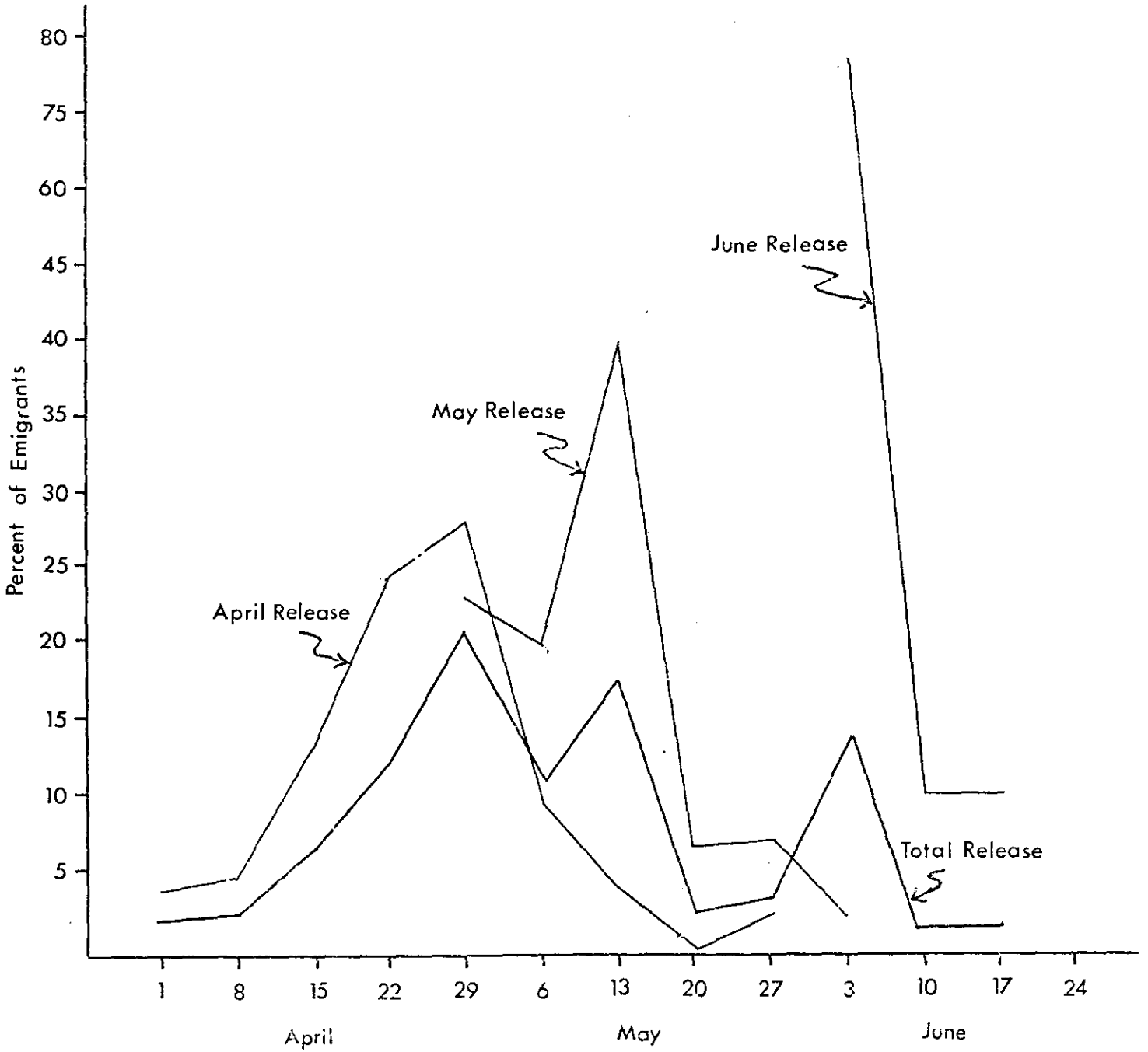

Figure 4. Time of emigration past Big Springs Creek Weir of juvenile steelhead reared at Hayden Creek Hatchery and released into the creek in April, May and June, 1973.

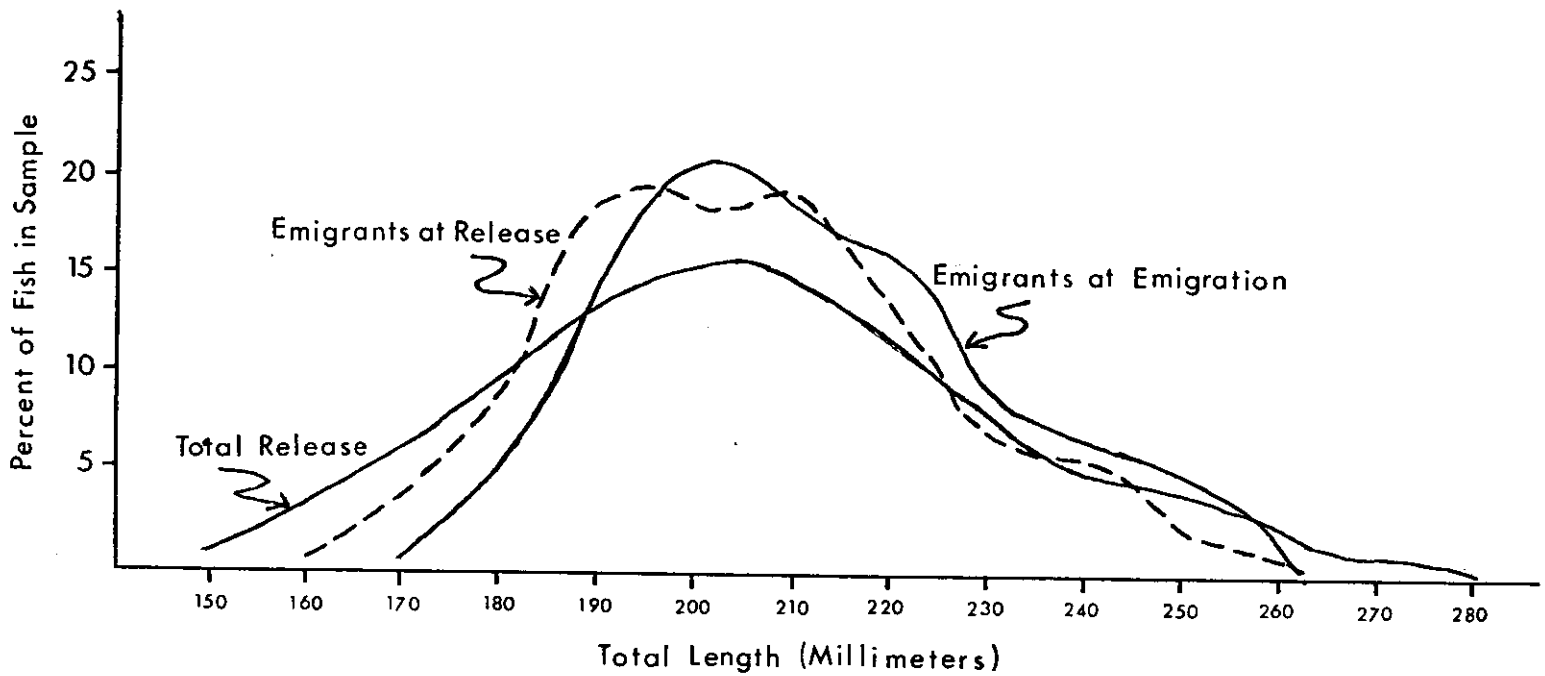

Figure 5. Length-frequency: (1) of all juvenile steelhead reared at Hayden Creek Hatchery at time they were released into Big Springs Creek, (2) at time of release of fish of the released group which subsequently emigrated from the creek, and (3) of the emigrants of the released group at the time of emigration.

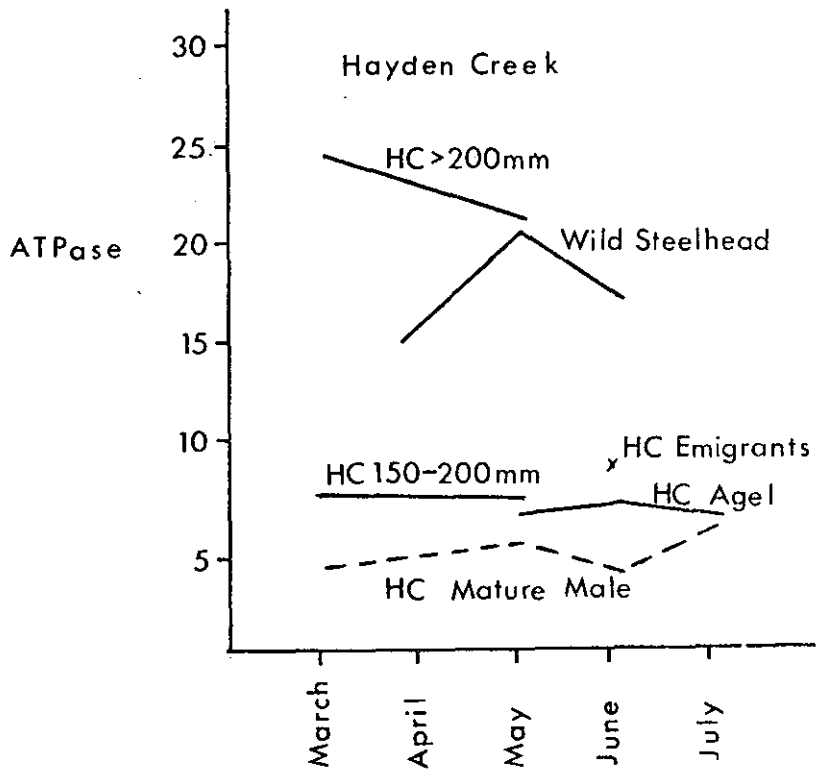

Figure 6. The concentration of sodium-potassium activated ATPase in gill tissue of juvenile steelhead reared at Hayden Creek Hatchery, of various size groups and time of spring, and wild steelhead captured at the Lemhi River Weirs.

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